



Altair

HyperWorks

HM-3610: Shaping a Dome Using Cyclic Symmetry

Model Files

This exercise uses the `bottle.hm` file, which can be found in the `hm.zip` file. Copy the file(s) from this directory to your working directory.

Exercise: Using Cyclical Symmetry to Assist in the Morphing of a Bottle

In this exercise you will create a dome shape at the bottom of the bottle using morph volumes.

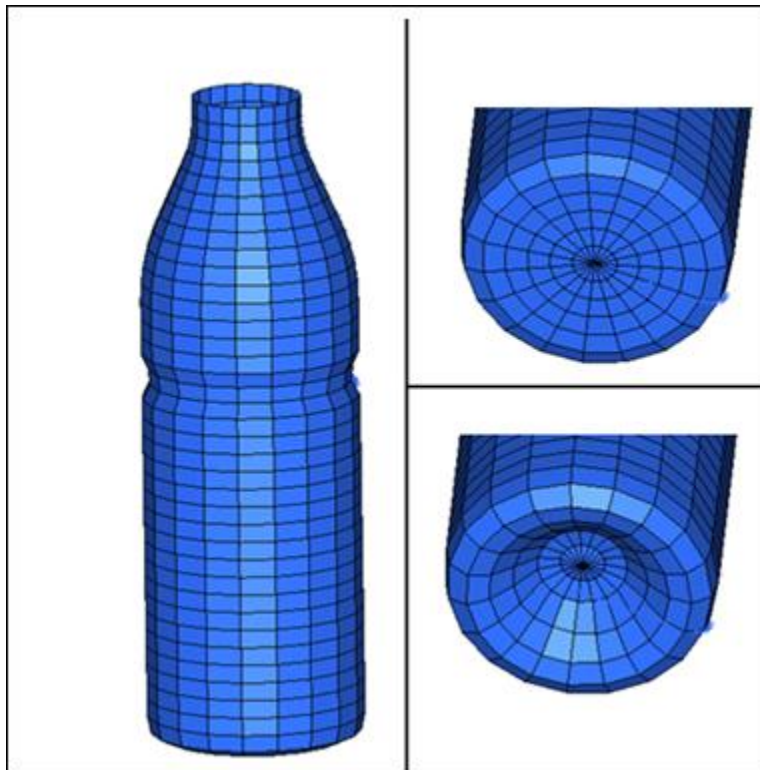


Figure 1: Before and after morphing

Step 1: Load and review the model.

Open the HyperMesh file `bottle.hm`

Step 2: Create morph volumes.

1. From the menu bar, select **Morphing > Create > Morph Volumes**.
2. Switch **create morphvol** to **create matrix**.

3. Set:
 - **x density** = 3
 - **y density** = 8
 - **z density** = 5
 - **buffer %** = 5
4. Select **elems >> displayed**.
5. Toggle **global system** to **local system**.
6. For **sys**, select the system located at the top of the bottle.
7. Use the default values for the remaining settings.
8. Click **create** to create the morph volumes.

Note: Morph volumes are created, encompassing the bottle, with red colored handles created at the corners of each morph volume.
9. Click **return** to exit the panel.


Step 3: Create symmetry.

1. From the menu bar, select **Morphing > Create > Symmetries**.
2. Under **domains**, activate **morph volumes & mapping** check box.

Symmetries can either be linked to domains or to morph volumes. Here you are associating the symmetries to the morph volumes.
3. Change **1 plane** to **cyclical**.
4. Change **180 degrees** to **set freq**.
5. Set **# of cycles** to 8.
6. For **sys** select the cylindrical coordinate system located at the top of the bottle.
7. Click **create**.

Note that a **cyclical** symmetry is created.
8. Click **return** to exit the panel.

Step 4: Create the dome.

1. From the menu bar select **Morphing > Create > Morph Volumes**, and then select the **update edges** subpanel.
2. Toggle **update nodes** to **update ends**.
3. Change the view to the bottom view by selecting the **XY Bottom Plane View** .

- Verify that the options **by edges** and **free** are selected (see image below).



- Using the image below as reference, select the line to the left of the tangency at the top of the center circle.

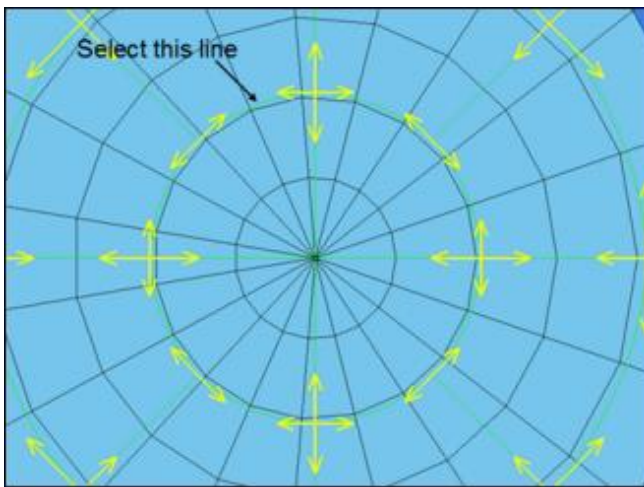


Figure 2: Updating tangencies, selecting line

- After selecting the line, select the tangency (shown below).

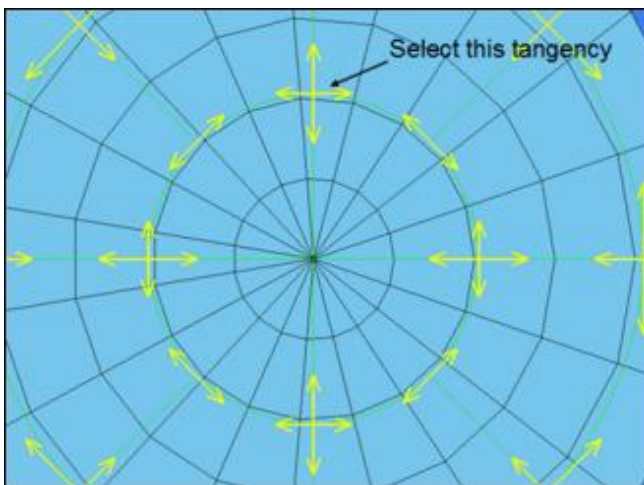


Figure 3: Updating tangencies, select tangency

Notice that after selecting the tangency, the two arrows are replaced with a single arrow.

- Repeat steps 5 and 6 on the three other tangencies shown in the image below:

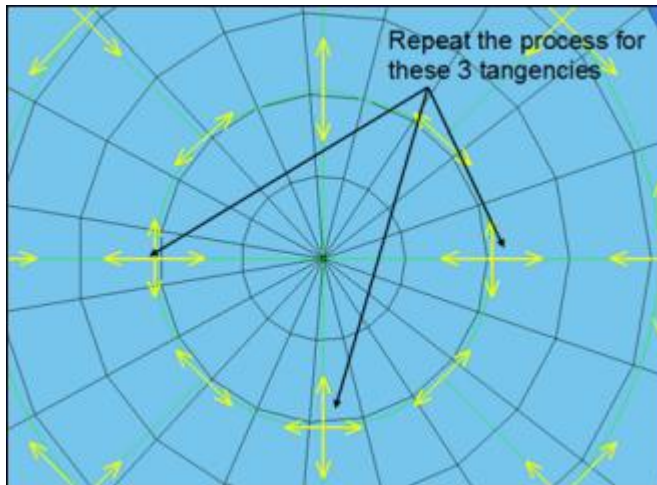


Figure 4: Updating tangencies, additional tangencies to update

- When finished, click **return** to exit the panel.
- From the menu bar select **Morphing > Morph** and then select the **move handles** subpanel:
- Select the handles at the bottom of the bottle, as shown in Figure 5.

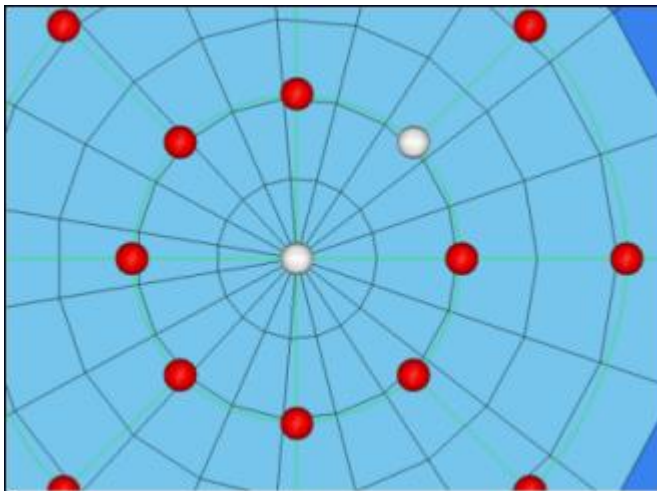


Figure 3: Handles to translate

- Switch the morphing method from **interactive** to **translate**.
- Switch to **along xyz**
- Set **z val = 10**
- Click **morph**.

Since you have symmetries defined, translating a single handle on the inner ring at the bottom, ensures that a similar behavior is imparted on all the handles symmetrically associated to it.

15. To reduce the number of domains and handles shown on the screen, click the **Mask** tab. If this isn't displayed, select **View > Browsers > HyperMesh > Mask**.
16. Click the - in the **Hide** column to turn off the display of all morphing entities.
17. Rotate the model to view the changes made.

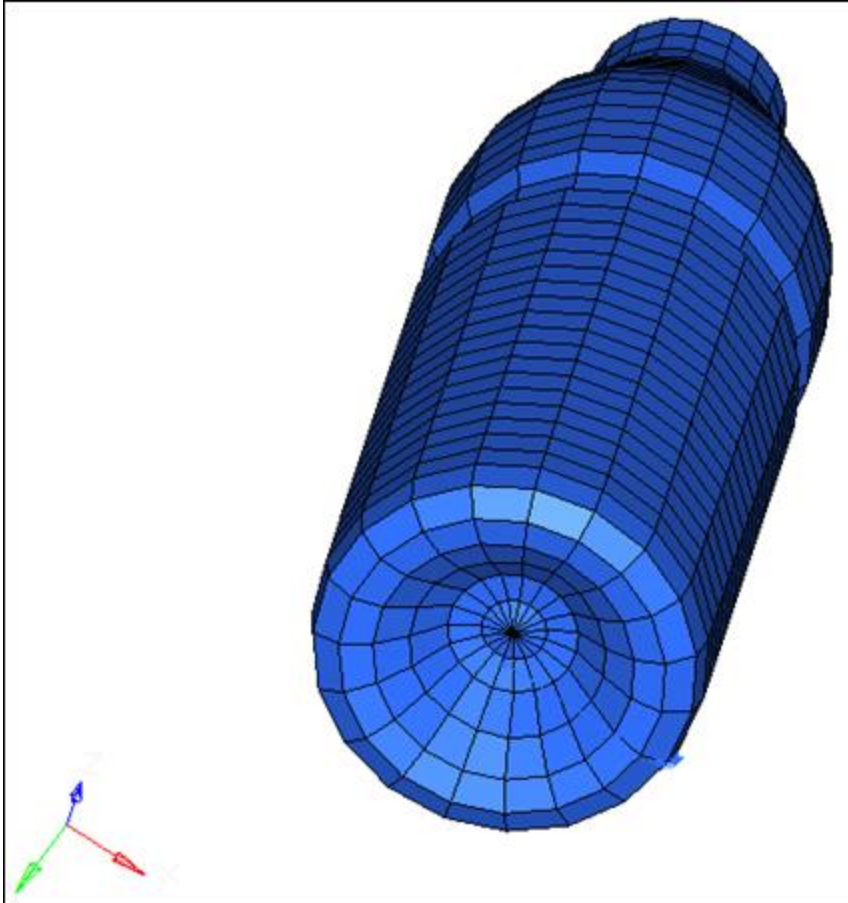


Figure 6: Morphed model

Summary

Using morph volumes with appropriate tangencies, and by creating symmetries you are able to create a dome-shaped feature at the bottom of the bottle.

Remarks

There are **four** different methods to define the continuity between the morph volumes.

- **Free** makes morph volume edges independent of other edges.
- **Fixed** connectivity allows you to prescribe the angle at the end of an edge.
- **Master-slave** maintains tangency between two morph volume edges while keeping the master edge independent of the slave edge. (When the master edge moves, the

slave edge follows, but when the slave edge moves, the master edge does not have to follow.)

- **Continuous** maintains tangency between two morph volume edges while allowing both edges to affect each other.

The default setting in morph volume is always set to **tangent** which is **continuous** edge connectivity. This definition can always be changed in the **update edges** subpanel, based upon the morphing needs.